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Residential Fuelwood Consumption and Production in the Plains States, 1994

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FOREWORD

This bulletin reports the results of a survey of residential fuelwood consumption and production in the Plains States for a 1-year period encompassing the 1993/1994 heating season. Topics examined include the geographic distribution of residential fuelwood consumption and production within the States; the species of trees used for residential fuelwood; the types of wood-burning facilities used; the reasons for burning fuelwood; and the land, ownership, and tree classes from which fuelwood was produced. Such detailed information is necessary for intelligent planning and decisionmaking in wood procurement, forest resource management, forest industry development, and forest research.

Special thanks are given to the households and commercial producers of the Plains States who supplied information for this study. Their cooperation is greatly appreciated.

The Kansas State University Department of Horticulture, Forestry and Recreation Resources is acknowledged for its cooperation in conducting the survey, and special thanks are offered to the faculty, staff, and students involved for their diligence in phoning and questioning the survey respondents.

In this bulletin, consumption refers to the volume of fuelwood burned by households in the Plains States, regardless of the source of the fuelwood (roundwood, wood residues from primary or secondary manufacturing, scrap or waste wood products, etc.). Production refers only to the volume of roundwood harvested to supply wood-burning households in the Plains States. This report *does not* include information about harvesting for industrial fuelwood. Such information is included in reports covering wood use by primary processing plants.

Row and column data of tables may not sum due to rounding, but data in each table cell are accurately displayed.

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Residential Fuelwood Consumption and Production in the Plains States, 1994

Dennis M. May

CONSUMPTION

- One in three households in the Plains States (fig. 1) had facilities to burn wood in 1994, but only 68 percent of them actually burned wood in that year (table 1).
- As a result, only about one in four households burned wood in 1994; a similar proportion planned to burn wood in 1995.
- The highest rates of household possession and use of wood-burning facilities in the Plains States were in Kansas, where 4 in 10 households possessed and 1 in 4 used wood-burning facilities. The lowest rates were in the Dakotas, where only one in four households possessed and only one in six used wood-burning facilities.
- In 1994, about 44,000 households planned to install wood-burning facilities. About two-thirds of the installations will be new; the rest will be replacement or supplemental units for households already engaged in wood-burning.
- Most of the increased possession and use of wood-burning facilities was expected to occur in Kansas.
- On average, each wood-burning household in the Plains States burned 1.35 cords of fuelwood in 1994, for a total consumption of about 640 thousand cords (table 2).

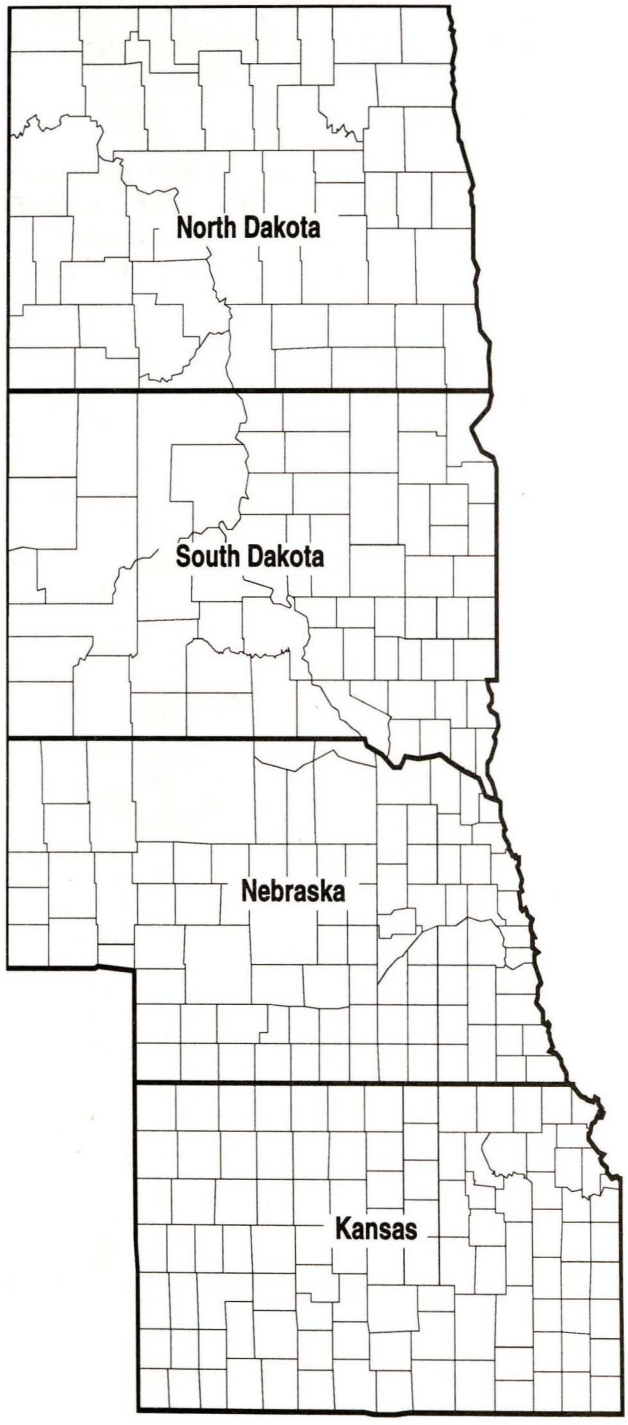

Figure 1.—*The Plains States.*

Dennis M. May, Research Forester, received a B.S. degree in forest management from the University of Maine and an M.S. degree in forest resources from the University of Idaho. He joined the USDA Forest Service in December 1983, and has been working with the North Central Station's Forest Inventory and Analysis Unit since May 1992.

- Households in Kansas and Nebraska burned four-fifths of the fuelwood consumed in 1994; Kansas households alone accounted for 58 percent of the total burned.

- Pleasure was the most popular reason for burning fuelwood in the Plains States in 1994. This was true in every State except South Dakota where burning wood as a secondary heat source was the most popular reason.

- On average, households that burned wood for pleasure consumed about half a cord of fuelwood, only a fraction of the volume consumed by households that heated with wood.

- As a result, more fuelwood was consumed for home-heating purposes than for pleasure in 1994 (table 2 and fig. 2).

- Fireplaces were the most popular type of wood-burning facility used by Plains States households in 1994 (table 3). This was true for every State except South Dakota where woodstoves were more popular than fireplaces.

- Almost two-thirds of households that burned wood in fireplaces did so for pleasure, while 89 percent of households that burned wood in wood stoves did so for home-heating purposes (table 4).

- As a result, more fuelwood was burned in wood stoves in 1994 than was burned in the far more numerous fireplaces (fig. 3).

- In 1994, three-fifths of Plains States wood burners had burned wood for at least 5 years (table 5).

- These veteran wood burners were more likely to burn wood as a primary heat source (fig. 4), and consequently burned almost three-quarters of the fuelwood consumed in 1994.

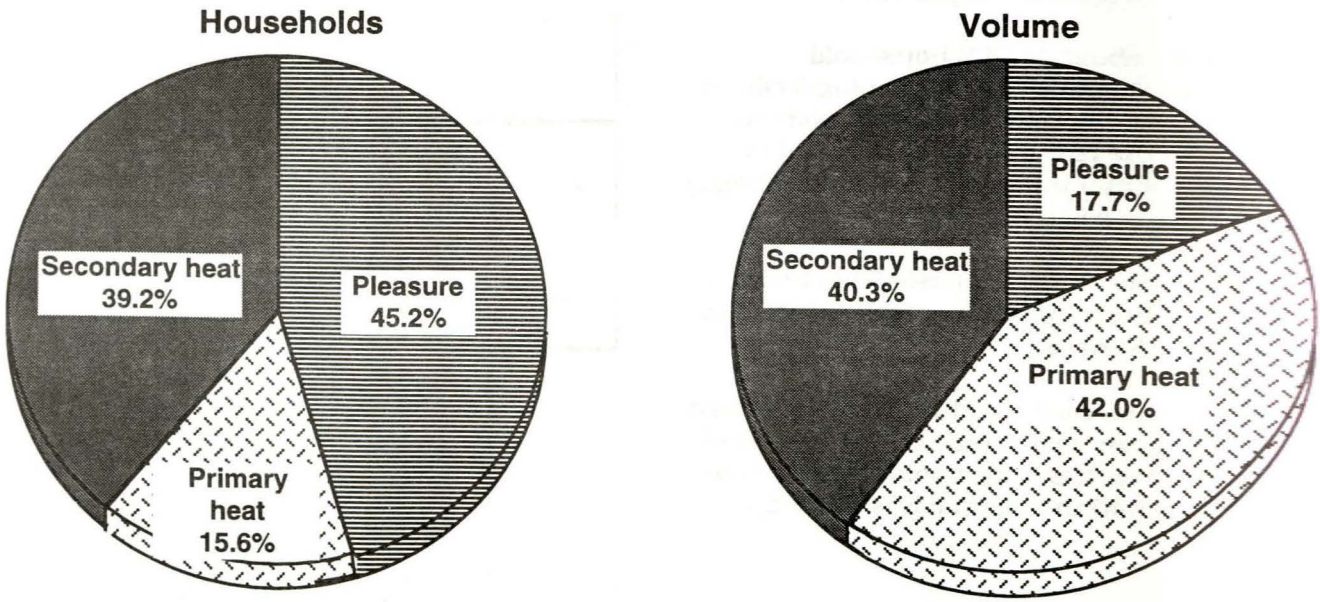

Figure 2.—*Distribution of residential fuelwood consumption by reason for burning, Plains States, 1994.*

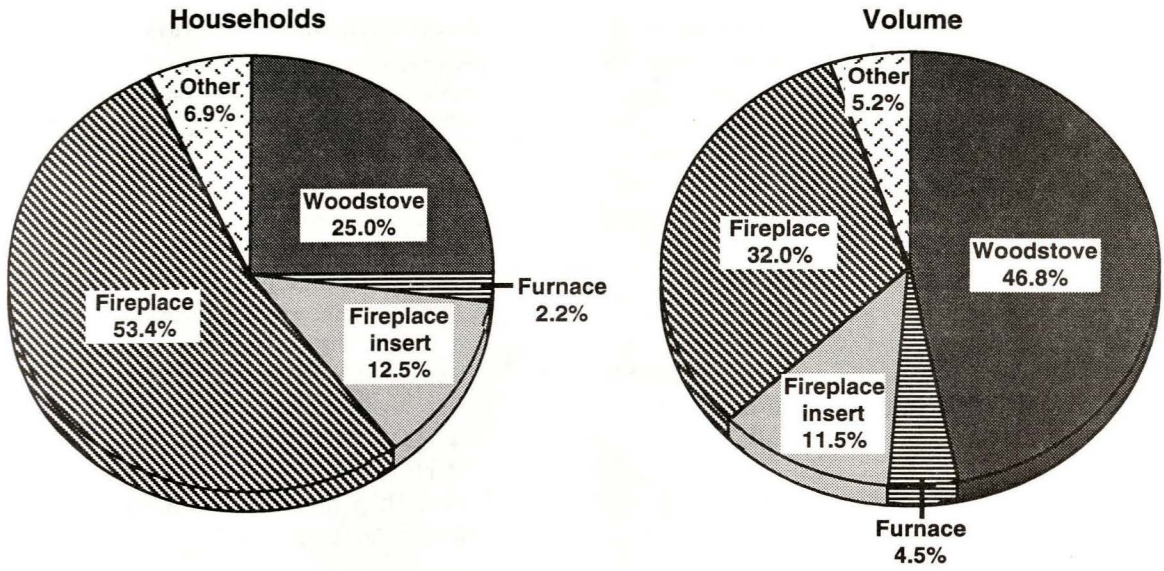

Figure 3.—*Distribution of residential fuelwood consumption by wood-burning facility, Plains States, 1994*

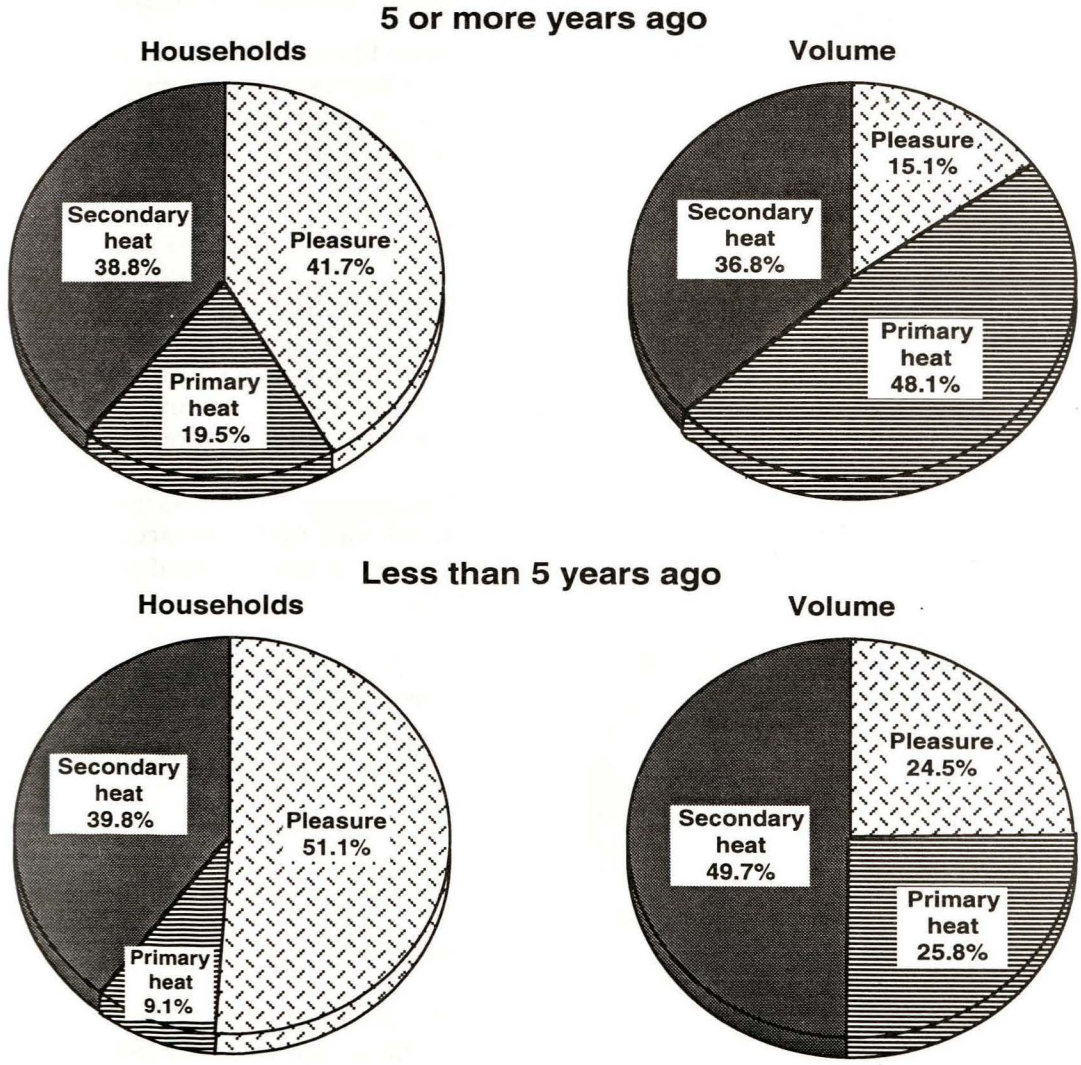

Figure 4.—*Distribution of residential fuelwood consumption by reason for burning and year first burned wood, Plains States, 1994.*

- Almost all (95 percent) of the fuelwood burned in 1994 was consumed at primary residences (table 6).

- Almost all (97 percent) of the fuelwood burned came from roundwood, but about 7 percent of the households relied on wood residues or pellets for all or part of their fuelwood needs in 1994 (table 7).

- Five main species—oak, elm, cottonwood, ash, and Osage-orange—accounted for 85 percent of the volume burned in 1994 (table 8).

- Oak and Osage-orange were the leading species burned in Kansas, while elm, ash, and cottonwood were generally the preferred species in the other Plains States.

- Softwoods made up only about 4 percent of the total consumption, but pine was one of the leading species burned in South Dakota.

- More than half (56 percent) of the wood-burning households in the Plains States cut all or part of the fuelwood they burned in 1994 (table 9).

- In total, three-fifths of the volume burned in 1994 was cut by residents of wood-burning households. Most of the remaining volume, one-third of total consumption, was purchased (fig. 5).

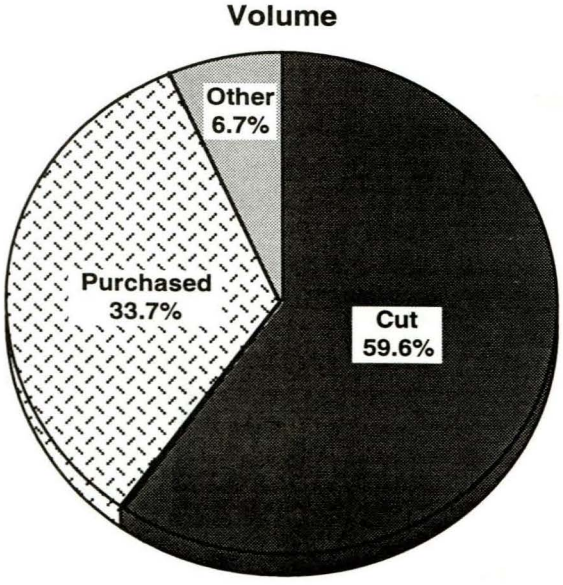

Figure 5.—*Distribution of residential fuelwood consumption by method of procurement, Plains States, 1994.*

- Purchased wood was most frequently delivered in cords of stove-length wood, commonly referred to as face cords or ricks (table 10). Sixteen-inch wood was most common, but 24-inch wood was also popular.

- On average, households that purchased fuelwood burned just over a cord of purchased wood each in 1994.

PRODUCTION

- In 1994, 604 thousand cords of roundwood fuelwood were cut in the Plains States to meet that region's residential fuelwood demands (table 11).

- More than four-fifths of this total was cut from Kansas and Nebraska; Kansas alone accounted for 54 percent of the total.

- More than a third of the 1994 production was harvested from forest land sources, mostly dead trees. The remainder was cut from a variety of nonforest land sources (fig. 6).

- South Dakota had the highest reliance on forest land of any Plains State, with close to half of its fuelwood production coming from forest land sources. North Dakota, with only a quarter of its fuelwood production coming from forest land sources, had the lowest reliance on forest land.

- Five species—elm, Osage-orange, cottonwood, oak, and ash—accounted for 86 percent of the fuelwood cut in 1994 (table 12).

- Osage-orange and oak were the preferred species cut for fuelwood in Kansas, while elm, ash, and cottonwood were the leading species harvested in the other Plains States (table 13).

- Although softwoods made up less than 4 percent of the fuelwood produced, pine was one of the leading fuelwood species cut in South Dakota.

- Private lands supplied 96 percent of the fuelwood harvested in 1994. The remainder was cut from a host of public lands, mainly county/municipal lands, and National Forest lands in South Dakota (tables 14, 15).

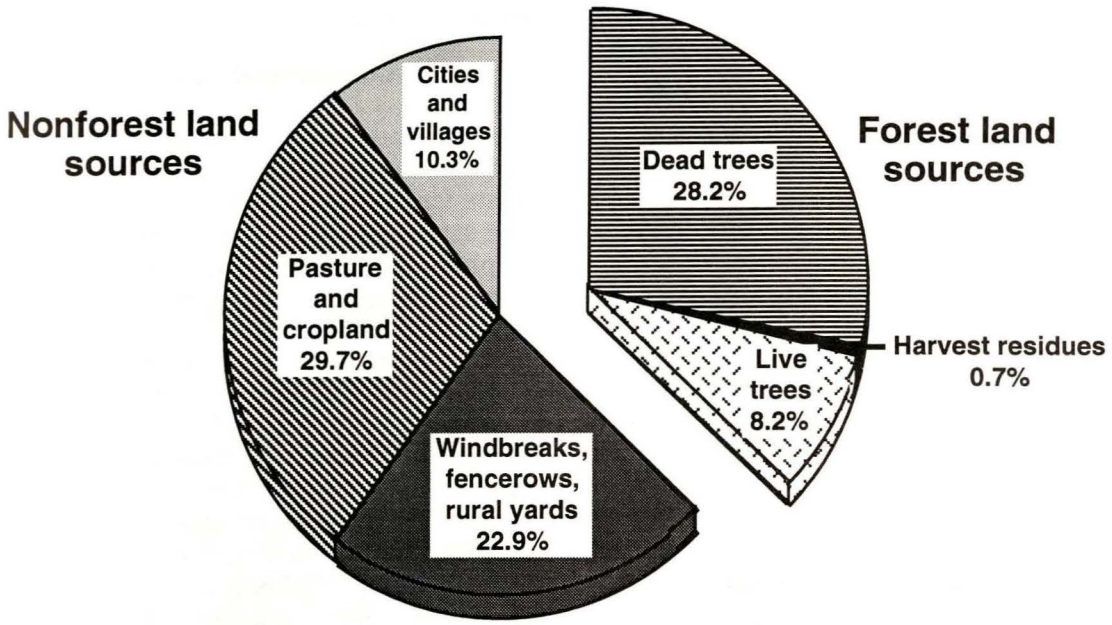

Figure 6.—*Distribution of residential fuelwood production by source of material, Plains States, 1994.*

- In 1994, only 3 percent of all fuelwood produced was cut from growing-stock portions of live timberland trees (tables 16, 17 and fig. 7). As a consequence, fuelwood removals had very little impact on the growing-stock inventory of the Plains States, the traditional supply source of that region's primary wood-using industry.

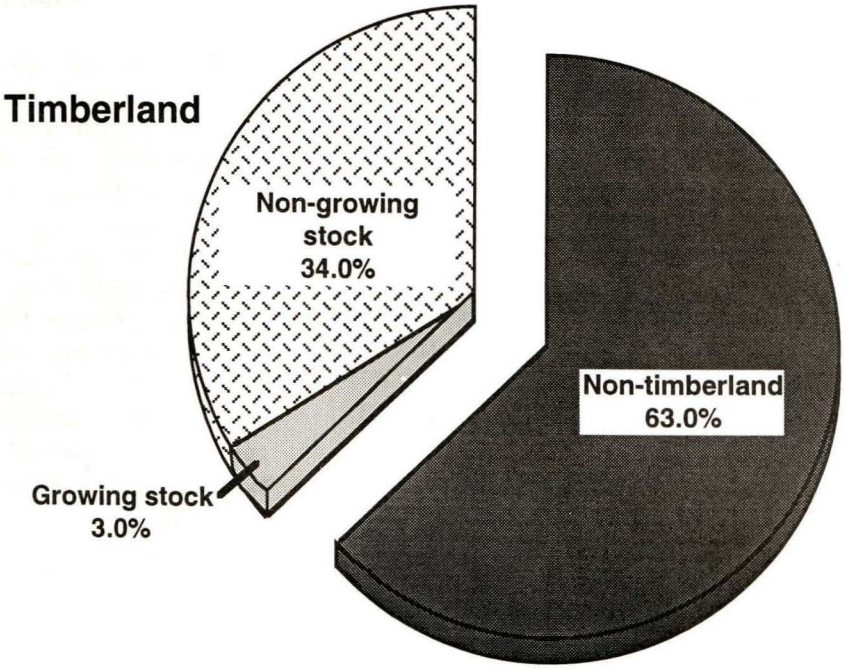

Figure 7.—*Distribution of timber removals associated with residential fuelwood production, Plains States, 1994.*

APPENDIX

STUDY METHODS

Data for this publication were collected by a telephone survey conducted during September 1994 by the Department of Horticulture, Forestry and Recreation Resources at Kansas State University. The telephone survey sampled Plains States households and canvassed all known commercial producers, using formal questionnaires prepared by the North Central Forest Experiment Station and approved by the Federal Office of Management and Budget.

Households

Each of the four Plains States was sampled separately. The sampled universe encompassed all households with telephones in a State. A total sample size of 900 households in each State was selected based on funding available and a desired standard error of less than ± 20 percent statewide at one standard deviation. Kansas and Nebraska were stratified into two sampling strata (urban and rural) based on population densities within counties. The total number of samples was disproportionally allocated to each stratum in these two States based on the number of households and the expected variation in fuelwood production in each stratum. North Dakota and South Dakota were not stratified and had one sampling stratum each. The strata samples were proportionally distributed across the counties in each stratum based on the number of households in each county. The county samples were evenly distributed across the three-digit telephone exchanges in each county. A random list of telephone numbers was generated for each county using all listed three-digit phone exchanges. One call was placed (whether successful or unsuccessful) to each of the random telephone numbers until the necessary number of residential households within each exchange and county was contacted. Sample rates ranged from about 1 in 2,071 households for the urban stratum in Kansas to about 1 in 267 households for North Dakota. Sample responses were expanded to population estimates of total fuelwood use based on the sample rates.

Commercial Producers

A list of commercial fuelwood producers was compiled for each Plains State from advertisements for firewood sales discovered in a one-time search of each State's newspapers and telephone directory yellow pages. In the search, 200 commercial producers were found in Kansas; 48 were found in Nebraska; 25 in South Dakota; and 20 in North Dakota. All of these commercial producers were canvassed about their production of residential fuelwood, using a formal questionnaire similar to that used for households. Possible duplicate sampling of commercial producers was minimized by cross checking telephone numbers of all sample households producing more than 20 cords of fuelwood against the commercial producers list.

Completed questionnaires were sent to the North Central Forest Experiment Station for editing and processing. Some respondents did not know the tree species cut or burned for fuel, except in general terms such as mixed hardwoods. As part of the processing, general species groupings were prorated to individual species specifically identified as being harvested or burned in a sampling stratum and Forest Survey Unit.

SAMPLING ERROR

All the reported figures are estimates based on sampling procedures that are designed to give accurate estimates of residential fuelwood consumption and production. A measure of reliability of these figures is given by sampling errors. This sampling error means that the chances are two out of three that the results for the sample differ by no more than the amount indicated from the results that would have been obtained if a complete census of all households and commercial producers had been made. Sampling errors for estimates of residential fuelwood consumption and production in the Plains States are shown on the next page.

State	Consumption (Cords)	Error (Percent)	Production (Cords)	Error (Percent)
Kansas	367,857	14.2	328,556	19.8
Nebraska	150,611	10.6	173,837	11.9
North Dakota	43,218	13.3	34,195	14.9
South Dakota	78,070	11.7	67,846	11.1
All States	639,755	8.7	604,433	11.4

STUDY LIMITATIONS

This study reports both the consumption and production of residential fuelwood in the Plains States for a 1-year period ending at the time of the telephone survey, essentially encompassing the 1993/1994 burning season, but dated 1994 for reporting purposes. Consumption refers to the volume of fuelwood burned by wood-burning households in the Plains States, regardless of the source of the fuelwood (roundwood, wood residues from primary or secondary manufacturing, scrap or waste wood products, etc.). Production, on the other hand, refers only to the volume of roundwood harvested to supply wood-burning households in the Plains States. Due to these definition differences, as well as seasoning time, leftover fuelwood inventories from previous years, gift or free wood, interstate wood movement, fluctuating participation in wood burning, and use of wood residues and wood wastes, estimates of fuelwood production and consumption should not be expected to match in a given year.

Additionally, production does not include fuelwood produced from wood residues generated at primary wood-using mills (such as sawmills and veneer mills), fuelwood produced from roundwood for industrial consumption, fuelwood produced from wood residues generated at secondary wood-using mills (such as millwork plants and furniture plants), or fuelwood produced from waste wood products. However, fuelwood produced from primary mill residues and fuelwood produced for industrial consumption are captured in other studies. And although fuelwood production from secondary mill residues and waste secondary wood products are beyond the scope of Forest Inventory and Analysis duties, part of this volume is captured in the consumption portion of the residential fuelwood studies.

Households without telephones were not sampled. To compensate for this omission, sample responses from households with phones were assumed representative of the relatively small number of households without phones, and were expanded across all existing households in each Plains State. Study results may be slightly biased if fuelwood consumption or production per household differs significantly in quantity or sources between phoneless households and households with phones.

Some commercial producers may not advertise in newspapers or the yellow pages, or may not have been advertising when the commercial producers list was compiled. Consequently, some commercial producers may have been excluded from the study, which would result in a conservative estimate of fuelwood production.

To assess the impacts of fuelwood harvesting on the forest inventory of the Plains States from telephone survey responses, reported fuelwood harvests from "woodland areas outside of city or village limits" were assumed to be the same as forest land harvests, and all forest land harvests were assumed to be timberland harvests.

DEFINITION OF TERMS

Central stem.—The portion of a tree between a 1-foot stump and the minimum 4.0-inch top diameter outside bark or the point where the central stem breaks into limbs.

Commercial producers.—Commercial fuelwood operators. Those who harvest fuelwood to sell to dealers or consumers. Includes loggers who harvest fuelwood along with saw logs and other products.

Commercial species.—Tree species presently or prospectively suitable for industrial wood

products. (Note: Excludes species of typically small size, poor form, or inferior quality such as hophornbeam, Osage-orange, and redbud.)

Cord (standard fuelwood) .—A pile of logs 4x4x8 feet (128 cubic feet including air space and bark). A standard cord of fuelwood contains 70 cubic feet of wood and 58 cubic feet of bark and air space.

Cull removals.—Net volume of rough and rotten trees, plus the net volume in sections of the central stem of growing-stock trees that do not meet regional merchantability standards, harvested for roundwood products.

Dead removals.—Net volume of dead trees harvested for roundwood products.

Diameter at breast height (d.b.h.) .—The outside bark diameter at 4.5 feet above the forest floor on the uphill side of the tree. For determining breast height, the forest floor includes the duff layer that may be present, but does not include unincorporated woody debris that may rise above the ground line.

Face cord.—A stack of stove length wood (most commonly 16 inches wide) that is 4 feet high and 8 feet long, locally referred to as a "rick."

Forest land.—Land at least 16.7 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use. (Note: Stocking is measured by comparing specified standards with basal area and/or number of trees, age or size, and spacing.) The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, or other bodies of water or clearings in forest areas shall be classed as forest if less than 120 feet wide.

Fuelwood consumption.—The fuelwood burned by residential households.

Fuelwood production.—The volume of roundwood harvested to supply residential households.

Growing-stock removals.—The growing-stock volume removed from the timberland inventory by harvesting roundwood products. (Note: Includes sawtimber removals, poletimber removals, and logging residues.)

Growing-stock tree.—A live timberland tree of commercial species that meets specified standards of size, quality, and merchantability. (Note: Excludes rough, rotten, and dead trees.)

Growing-stock volume.—Net volume of growing-stock trees 5.0 inches d.b.h. and over, from 1 foot above the ground to a minimum 4.0-inch top diameter outside bark of the central stem or to the point where the central stem breaks into limbs.

Hardwoods .—Dicotyledonous trees, usually broad-leaved and deciduous.

Harvest residues.—The total net volume of unused portions of trees cut or killed by logging. (Note: Includes both logging residues and logging slash.)

Limbwood removals.—Net volume of all portions of a tree other than the central stem, (including forks, large limbs, tops, and stumps) harvested for roundwood products.

Logging residue .—The net volume of unused portions of the merchantable central stem of growing-stock trees cut or killed by logging.

Logging slash .—The net volume of unused portions of the unmerchantable (non-growing-stock) sections of trees cut or killed by logging.

Merchantable sections.—Sections of the central stem of growing-stock trees that meet either pulpwood or saw-log specifications.

Net volume.—Gross volume less deductions for rot, sweep, or other defects affecting use for roundwood products.

Noncommercial species.—Tree species of typically small size, poor form, or inferior quality that normally do not develop into trees suitable for industrial roundwood products.

Nonforest land .—Land that has never supported forests, and land formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width, and 1- to 39.9-acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, improved roads and nonforest strips must be more than 120 feet wide and more than 1 acre to qualify as nonforest land.)

Nonforest land removals .—Net volume of trees on nonforest lands harvested for roundwood products.

Nontimberland .—The same as nonforest land in this report.

Poletimber.—A growing-stock tree at least 5.0 inches d.b.h. but smaller than sawtimber size (9.0 inches d.b.h. for softwoods, 11.0 inches d.b.h. for hardwoods).

Poletimber removals.—Net volume in the merchantable central stem of poletimber trees harvested for roundwood products.

Primary wood-using mills .—Mills receiving roundwood or chips from roundwood for processing into primary wood products (lumber, veneer, woodpulp, etc.).

Rotten tree.—A tree that does not meet regional merchantability standards because of excessive unsound cull.

Rough tree.—A tree that does not meet regional merchantability standards because of excessive sound cull. Includes noncommercial tree species.

Roundwood.—Logs, bolts, or other round sections cut from trees (including chips from roundwood).

Sapling .—A live tree between 1.0 and 5.0 inches d.b.h.

Sapling removals .—Net volume in saplings harvested for roundwood products.

Saw-log portion .—That portion of the central stem of sawtimber trees between the stump and the saw-log top.

Saw-log top .—The point on the central stem of sawtimber trees above which a saw log cannot be produced. The minimum saw-log top is 7.0 inches diameter outside bark (d.o.b.) for softwoods and 9.0 inches d.o.b. for hardwoods.

Sawtimber removals .—The net volume in the merchantable central stem of sawtimber trees harvested for roundwood products. (Note: Includes the saw-log and upper-stem portions of sawtimber trees.)

Sawtimber tree .—A growing-stock tree containing at least a 12-foot saw log or two noncon-tiguous saw logs 8 feet or longer, and meeting regional specifications for freedom from defect. Softwoods must be at least 9.0 inches d.b.h. and hardwoods must be at least 11.0 inches d.b.h.

Secondary wood-using mills .—Mills receiving primary wood products for manufacture into secondary wood products (furniture, cabinets, etc.).

Softwoods .—Coniferous trees, usually evergreen, having needles or scale-like leaves.

Tree.—A woody plant usually having one or more perennial stems, a more or less definitely formed crown of foliage, and a height of at least 12 feet at maturity.

Timberland .—Forest land that is producing, or is capable of producing, in excess of 20 cubic feet per acre per year of industrial roundwood products under natural conditions, is not withdrawn from timber utilization by statute or administrative regulation, and is not associated with urban or rural development. In this report, all forest land removals were assumed to be timberland removals.

Upper stem portion.—That portion of the central stem of sawtimber trees between the saw-log top and the minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

Wood residues.—Includes woody material (bark, coarse, fine, etc.) generated at primary wood-using mills, woody material (sawdust, scrap, trim, wood flour, etc.) generated at secondary wood-using plants, and waste secondary wood products.

COMMON AND SCIENTIFIC NAMES OF TREE SPECIES MENTIONED

SOFTWOODS

Cedar
- Rocky mountain juniper ..... *Juniperus scopulorum*
- Eastern redcedar ..... *Juniperus virginiana*

Pine
- Austrian pine ..... *Pinus nigra*
- Ponderosa pine ..... *Pinus ponderosa*
- Scotch pine ..... *Pinus sylvestris*

HARDWOODS

Ash
- White ash ..... *Fraxinus americana*
- Black ash ..... *Fraxinus nigra*
- Green ash ..... *Fraxinus pennsylvanica*

Aspen
- Quaking aspen ..... *Populus tremuloides*

Birch
- River birch ..... *Betula nigra*
- Paper birch ..... *Betula papyrifera*

Boxelder ..... *Acer negundo*

Catalpa
- Northern catalpa ..... *Catalpa speciosa*

Cottonwood
- Eastern cottonwood ..... *Populus deltoides*
- Plains cottonwood ..... *Populus deltoides* var. *occidentalis*

Elm
- American elm ..... *Ulmus americana*
- Siberian elm ..... *Ulmus pumila*
- Slippery elm ..... *Ulmus rubra*
- Rock elm ..... *Ulmus thomasii*

Hackberry ..... *Celtis occidentalis*

Hickory
- Bitternut hickory ..... *Carya cordiformis*
- Shellbark hickory ..... *Carya laciniosa*
- Shagbark hickory ..... *Carya ovata*
- Black hickory ..... *Carya texana*
- Mockernut hickory ..... *Carya tomentosa*

Locust
- Black locust ..... *Robinia pseudoacacia*
- Honeylocust ..... *Gleditsia triacanthos*

Maple
- Silver maple ..... *Acer saccharinum*

Mulberry
- Red mulberry ..... *Morus rubra*
- White mulberry ..... *Morus alba*

Oak

Red oak
- Northern red oak ..... *Quercus rubra*
- Black oak ..... *Quercus velutina*
- Blackjack oak ..... *Quercus marilandica*
- Shumard oak ..... *Quercus shumardii*
- Shingle oak ..... *Quercus imbricaria*
- Pin oak ..... *Quercus palustris*

White oak
- White oak ..... *Quercus alba*
- Bur oak ..... *Quercus macrocarpa*
- Chinkapin oak ..... *Quercus muehlenbergii*
- Post oak ..... *Quercus stellata*

Pecan ..... *Carya illinoensis*

Sassafras ..... *Sassafras albidum*

Walnut
- Black walnut ..... *Juglans nigra*

Willow
- Black willow ..... *Salix nigra*
- Willow ..... *Salix* spp.

Noncommercial species
- Apple ..... *Malus* spp.
- Cherry/plum ..... *Prunus* spp.
- Ironwood ..... *Ostrya virginiana*
- Osage-orange ..... *Maclura pomifera*

TABLE TITLES

Table 1.—Household possession and use of wood-burning facilities by State, Plains States, 1994

Table 2.—Residential fuelwood consumption by reason for burning and State, Plains States, 1994

Table 3.—Residential fuelwood consumption by type of wood-burning facility and State, Plains States, 1994

Table 4.—Residential fuelwood consumption by type of wood-burning facility and reason for burning, Plains States, 1994

Table 5.—Residential fuelwood consumption by reason for burning and year first burned wood, Plains States, 1994

Table 6.—Residential fuelwood consumption by place of consumption and State, Plains States, 1994

Table 7.—Residential fuelwood consumption by type of fuelwood and State, Plains States, 1994

Table 8.—Residential fuelwood consumption by species group and State, Plains States, 1994

Table 9.—Residential fuelwood consumption by method of procurement and State, Plains States, 1994

Table 10.—Residential consumption of purchased fuelwood by size of wood, Plains States, 1994

Table 11.—Residential fuelwood production by source of material and State, Plains States, 1994

Table 12.—Residential fuelwood production from roundwood by species group and source of material, Plains States, 1994

Table 13.—Residential fuelwood production from roundwood by species group and State, Plains States, 1994

Table 14.—Residential fuelwood production from roundwood by species group and ownership class, Plains States, 1994

Table 15.—Residential fuelwood production from roundwood by source of material and ownership class, Plains States, 1994

Table 16.—Distribution of timber removals associated with residential fuelwood production by State, Plains States, 1994

Table 17.—Distribution of timber removals associated with residential fuelwood production by species group, Plains States, 1994

Table 1. -- Household possession and use of wood-burning facilities by State, Plains States, 1994

(In number of households)

State	Households	Households with wood-burning facilities	Households burning wood in 1994	Households planning to burn wood in 1995	Households planning to install wood-burning facilities
Kansas	944,726	368,760	259,147	280,822	21,738
Nebraska	602,363	193,424	125,901	141,216	10,289
North Dakota	240,878	64,163	43,310	43,577	3,475
South Dakota	259,034	66,625	45,661	49,107	8,041
Total	2,047,001	692,971	474,019	514,723	43,544

Table 2. -- Residential fuelwood consumption by reason for burning and State, Plains States, 1994

State and reason for burning	Number of households	Volume (Cords)	Average (Cords/ household)
Kansas			
Pleasure	117,399	56,619	0.48
Primary heat	38,161	165,304	4.33
Secondary heat	103,587	145,933	1.41
Total	259,147	367,857	1.42
Nebraska			
Pleasure	56,301	31,762	0.56
Primary heat	23,612	69,174	2.93
Secondary heat	45,988	49,675	1.08
Total	125,901	150,611	1.20
North Dakota			
Pleasure	23,794	13,964	0.59
Primary heat	4,812	10,511	2.18
Secondary heat	14,704	18,742	1.27
Total	43,310	43,218	1.00
South Dakota			
Pleasure	16,943	10,598	0.63
Primary heat	7,179	23,762	3.31
Secondary heat	21,538	43,710	2.03
Total	45,661	78,070	1.71
All States			
Pleasure	214,437	112,945	0.53
Primary heat	73,764	268,751	3.64
Secondary heat	185,817	258,059	1.39
Total	474,019	639,755	1.35

Table 3. -- Residential fuelwood consumption by type of wood-burning facility and State, Plains States, 1994

State and type of wood-burning facility	Number of households	Volume (Cords)	Average (Cords/ household)
Kansas			
Stove	57,640	178,371	3.09
Furnace	4,268	10,093	2.36
Fireplace insert	39,146	46,529	1.19
Fireplace	147,548	124,002	0.84
Fire pit	6,277	1,296	0.21
Combinations	4,268	7,565	1.77
Total	259,147	367,857	1.42
Nebraska			
Stove	30,391	62,106	2.04
Furnace	4,094	13,228	3.23
Fireplace insert	11,611	12,587	1.08
Fireplace	69,234	51,961	0.75
Fire pit[1]	6,282	4,602	0.73
Combinations	4,289	6,127	1.43
Total	125,901	150,611	1.20
North Dakota			
Stove	13,367	19,136	1.43
Furnace	1,337	3,433	2.57
Fireplace insert	2,406	2,074	0.86
Fireplace	19,516	15,343	0.79
Fire pit	5,614	2,325	0.41
Combinations	1,069	907	0.85
Total	43,310	43,218	1.00
South Dakota			
Stove	17,231	39,438	2.29
Furnace	862	2,294	2.66
Fireplace insert	6,031	12,376	2.05
Fireplace	16,656	13,250	0.80
Fire pit	2,872	2,811	0.98
Combinations	2,010	7,900	3.93
Total	45,661	78,070	1.71
All States			
Stove	118,630	299,052	2.52
Furnace	10,560	29,049	2.75
Fireplace insert	59,194	73,566	1.24
Fireplace	252,954	204,556	0.81
Fire pit[1]	21,045	11,033	0.52
Combinations	11,637	22,499	1.93
Total	474,019	639,755	1.35

[1] Includes small volumes for livestock water heaters and meat smokers.

Table 4. -- Residential fuelwood consumption by type of wood-burning facility and reason for burning, Plains States, 1994

Type of facility	All reasons		Reason for burning					
			Pleasure		Primary heat		Secondary heat	
	Number of households	Volume (Cords)	Number of households	Volume (Cords)	Number of households	Volume (Cords)	Number of households	Volume (Cords)
Stove	118,630	299,052	13,455	7,903	48,667	199,367	56,508	91,782
Furnace	10,560	29,049	-	-	7,069	20,360	3,492	8,688
Fireplace insert	59,194	73,566	16,708	8,944	7,657	18,210	34,829	46,412
Fireplace	252,954	204,556	162,675	87,172	7,043	20,056	83,236	97,328
Fire pit[1]	21,045	11,033	20,092	8,584	953	2,449	-	-
Combinations	11,637	22,499	1,508	342	2,376	8,308	7,753	13,849
Total	474,019	639,755	214,437	112,945	73,764	268,751	185,817	258,059

[1] Includes small volumes for livestock water heaters and meat smokers.

Table 5. -- Residential fuelwood consumption by reason for burning and year first burned wood, Plains States, 1994

Reason for burning and year first burned wood	Number of households	Volume (Cords)	Average (Cords/ household)
Pleasure			
Last year	57,573	24,506	0.43
2 years ago	23,549	11,047	0.47
3 years ago	8,082	6,158	0.76
4 years ago	2,977	1,100	0.37
5 or more years ago	122,256	70,133	0.57
Total	214,437	112,945	0.53
Primary heat			
Last year	7,479	13,929	1.86
2 years ago	3,642	15,947	4.38
3 years ago	1,860	5,050	2.72
4 years ago	3,459	10,137	2.93
5 or more years ago	57,325	223,687	3.90
Total	73,764	268,751	3.64
Secondary heat			
Last year	24,408	25,382	1.04
2 years ago	19,110	25,584	1.34
3 years ago	18,436	19,608	1.06
4 years ago	9,926	16,192	1.63
5 or more years ago	113,937	171,294	1.50
Total	185,817	258,059	1.39
All reasons			
Last year	89,460	63,817	0.71
2 years ago	46,301	52,578	1.14
3 years ago	28,378	30,816	1.09
4 years ago	16,363	27,429	1.68
5 or more years ago	293,518	465,115	1.58
Total	474,019	639,755	1.35

Table 6. -- Residential fuelwood consumption by place of consumption and State, Plains States, 1994

State and place of consumption	Number of households	Volume consumed					Average (Cords/ household)
		Primary residence (Cords)	Secondary residence (Cords)	Other building (Cords)	Other[1] (Cords)	Total consumption (Cords)	
Kansas							
Primary residence	250,673	354,829	-	-	-	354,829	1.42
Secondary residence	1,423	-	1,177	-	-	1,177	0.83
Other building	2,845	-	-	5,630	-	5,630	1.98
Other[1]	3,494	-	-	-	886	886	0.25
Combination	711	4,268	-	1,067	-	5,335	7.50
Total	259,147	359,097	1,177	6,696	886	367,857	1.42
Nebraska							
Primary residence	116,283	141,057	-	-	-	141,057	1.21
Other building	2,859	-	-	2,569	-	2,569	0.90
Other[1]	6,282	-	-	-	4,602	4,602	0.73
Combination	477	1,191	1,191	-	-	2,383	5.00
Total	125,901	142,249	1,191	2,569	4,602	150,611	1.20
North Dakota							
Primary residence	34,755	35,725	-	-	-	35,725	1.03
Secondary residence	802	-	3,900	-	-	3,900	4.86
Other building	2,406	-	-	1,744	-	1,744	0.72
Other[1]	4,812	-	-	-	1,376	1,376	0.29
Combination	535	245	187	41	-	473	0.88
Total	43,310	35,970	4,087	1,785	1,376	43,218	1.00
South Dakota							
Primary residence	40,492	70,618	-	-	-	70,618	1.74
Secondary residence	287	-	689	-	-	689	2.40
Other building	2,297	-	-	4,464	-	4,464	1.94
Other[1]	2,297	-	-	-	2,011	2,011	0.88
Combination	287	57	-	-	230	287	1.00
Total	45,661	70,676	689	4,464	2,241	78,070	1.71
All States							
Primary residence	442,203	602,230	-	-	-	602,230	1.36
Secondary residence	2,512	-	5,766	-	-	5,766	2.30
Other building	10,408	-	-	14,406	-	14,406	1.38
Other[1]	16,886	-	-	-	8,875	8,875	0.53
Combination	2,010	5,762	1,379	1,108	230	8,478	4.22
Total	474,019	607,992	7,145	15,515	9,104	639,755	1.35

[1] Consumed at campsites, livestock water heaters, and meat smokers

Table 7. -- Residential fuelwood consumption by type of fuelwood and State, Plains States, 1994

State and type of fuelwood	Number of households	Volume consumed				Average (Cords/ household)
		Roundwood (Cords)	Wood residues (Cords)	Wood pellets (Cords)	Total consumption (Cords)	
Kansas						
Roundwood	243,036	343,417	-	-	343,417	1.41
Wood residues	4,205	-	4,349	-	4,349	1.03
Combination	11,905	15,110	4,981	-	20,091	1.69
Total	259,147	358,527	9,330	-	367,857	1.42
Nebraska						
Roundwood	120,572	136,817	-	-	136,817	1.13
Wood residues	1,430	-	1,230	-	1,230	0.86
Combination	3,899	8,119	4,445	-	12,564	3.22
Total	125,901	144,936	5,675	-	150,611	1.20
North Dakota						
Roundwood	37,963	38,700	-	-	38,700	1.02
Wood residues	1,871	-	448	-	448	0.24
Combination	3,475	2,644	1,426	-	4,070	1.17
Total	43,310	41,344	1,874	-	43,218	1.00
South Dakota						
Roundwood	41,066	72,174	-	-	72,174	1.76
Wood residues	1,436	-	2,426	-	2,426	1.69
Wood pellets	574	-	-	555	555	0.97
Combination	2,585	2,137	778	-	2,915	1.13
Total	45,661	74,310	3,205	555	78,070	1.71
All States						
Roundwood	442,638	591,108	-	-	591,108	1.34
Wood residues	8,942	-	8,453	-	8,453	0.95
Wood pellets	574	-	-	555	555	0.97
Combination	21,864	28,009	11,630	-	39,640	1.81
Total	474,019	619,117	20,083	555	639,755	1.35

Table 8. -- Residential fuelwood consumption by species group and State, Plains States, 1994

(In cords)

Species group	All States	State			
		Kansas	Nebraska	North Dakota	South Dakota
Softwoods					
Cedar	5,804	1,935	3,234	129	506
Spruce	178	-	-	-	178
Pine	19,359	973	2,064	1,088	15,234
Total softwoods	25,340	2,908	5,298	1,217	15,917
Hardwoods					
Maple	3,012	2,375	-	-	637
Boxelder	4,464	-	1,917	2,180	366
Birch	6,665	825	-	5,451	388
Hickory	4,069	2,366	1,703	-	-
Pecan	1,292	1,292	-	-	-
Catalpa	1,186	504	682	-	-
Hackberry	28,952	27,724	1,228	-	-
Ash	88,744	23,294	35,683	7,731	22,036
Locust	3,294	2,034	1,207	53	-
Walnut	4,762	2,711	1,801	-	251
Osage-orange	74,503	71,537	2,966	-	-
Apple[1]	5,699	932	4,393	41	334
Mulberry	6,102	3,797	2,305	-	-
Ironwood	392	-	392	-	-
Cottonwood	90,664	24,566	39,701	11,443	14,955
Aspen	2,474	-	-	784	1,691
Cherry	53	-	-	53	-
Plum	152	-	-	-	152
Oak	185,331	156,727	18,108	7,827	2,670
Willow	362	44	-	318	-
Sassafras	101	101	-	-	-
Elm	102,141	44,122	33,226	6,120	18,673
Total hardwoods	614,416	364,949	145,313	42,001	62,153
All species	639,755	367,857	150,611	43,218	78,070

[1] Includes apricot, pear, and Russian olive.

Table 9. -- Residential fuelwood consumption by method of procurement and State, Plains States, 1994

State and procurement method	Number of households	Volume purchased (Cords)	Volume cut (Cords)	Volume other[1] (Cords)	Total consumption (Cords)	Average (Cords/ household)
Kansas						
Buy[1]	127,357	131,197	-	13,291	144,488	1.13
Cut	101,179	-	175,221	-	175,221	1.73
Cut and buy[1]	30,610	15,503	23,603	9,042	48,148	1.57
Total	259,147	146,699	198,824	22,333	367,857	1.42
Nebraska						
Buy[1]	42,718	27,655	-	6,394	34,049	0.80
Cut	68,257	-	91,429	-	91,429	1.34
Cut and buy[1]	14,926	3,072	15,724	6,336	25,132	1.68
Total	125,901	30,727	107,153	12,730	150,611	1.20
North Dakota						
Buy[1]	20,051	11,674	-	2,190	13,864	0.69
Cut	19,249	-	24,892	-	24,892	1.29
Cut and buy[1]	4,010	491	2,807	1,164	4,462	1.11
Total	43,310	12,165	27,698	3,355	43,218	1.00
South Dakota						
Buy[1]	17,805	22,387	-	2,948	25,335	1.42
Cut	22,400	-	42,260	-	42,260	1.89
Cut and buy[1]	5,456	3,599	5,175	1,702	10,475	1.92
Total	45,661	25,986	47,435	4,649	78,070	1.71
All States						
Buy[1]	207,931	192,912	-	24,823	217,736	1.05
Cut	211,085	-	333,802	-	333,802	1.58
Cut and buy[1]	55,002	22,665	47,308	18,244	88,217	1.60
Total	474,019	215,578	381,110	43,067	639,755	1.35

[1] Includes gift wood, free wood, leftover wood, etc.

Table 10. -- Residential consumption of purchased fuelwood by size of wood, Plains States, 1994

Size of wood purchased	Number of households	Volume (Cords)	Average (Cords/ household)
16 inch	108,623	125,533	1.16
24 inch	58,995	47,528	0.81
4 foot	3,680	2,589	0.70
6 foot	555	543	0.98
8 foot	3,766	6,198	1.65
Random length residues	4,910	2,056	0.42
Random length roundwood	28,248	31,020	1.10
Tree length	287	111	0.39
Total	209,064	215,578	1.03

Table 11. -- Residential fuelwood production by source of material and State, Plains States, 1994

(In cords)

State	All sources	Source of material					
		Cities and villages	Windbreaks, fencerows, rural yards	Pasture and cropland	Forest land		
					Standing live trees	Harvest residues	Dead trees
Kansas	328,556	19,502	57,167	125,888	42,580	1,622	81,798
Nebraska	173,837	34,793	40,435	40,935	4,859	1,235	51,581
North Dakota	34,195	2,781	20,663	2,660	279	-	7,812
South Dakota	67,846	5,355	20,214	10,271	2,004	1,051	28,950
Total	604,433	62,430	138,479	179,754	49,721	3,908	170,141

Table 12. -- Residential fuelwood production from roundwood by species group and source of material, Plains States, 1994

(In cords)

Species group	All sources	Source of material					
					Forest land		
		Cities and villages	Windbreaks, fencerows, rural yards	Pasture and cropland	Standing live trees	Harvest residues	Dead trees
Softwoods							
Cedar	7,183	3,878	93	560	658	9	1,985
Pine	14,963	1,591	2,066	1,354	1,297	620	8,035
Total softwoods	22,146	5,469	2,159	1,914	1,955	629	10,020
Hardwoods		*					
Maple	3,391	521	631	829	1,384	-	26
Boxelder	8,580	1,155	2,987	2,677	1	-	1,761
Birch	1,120	30	361	315	-	-	414
Hickory	4,356	2,162	423	1,295	30	11	434
Pecan	1,167	5	689	472	-	-	-
Catalpa	876	-	-	-	-	-	876
Hackberry	13,867	507	3,539	2,982	622	6	6,209
Ash	78,806	2,234	15,283	21,282	5,629	264	34,113
Locust	3,354	155	973	791	-	-	1,435
Walnut	9,331	1,164	3,185	2,130	666	36	2,151
Osage-orange	119,286	3,272	24,465	66,846	9,616	941	14,146
Apple[1]	6,833	5,458	881	487	-	-	7
Mulberry	4,745	1,165	1,992	1,406	180	-	1
Ironwood	422	-	-	-	-	-	422
Cottonwood	96,440	3,779	29,419	27,435	13,908	-	21,898
Aspen	2,306	41	261	950	42	359	653
Cherry	40	2	38	*	-	-	-
Oak	91,414	9,393	7,194	27,068	9,832	1,319	36,609
Willow	288	11	235	4	3	-	35
Elm	135,663	25,906	43,761	20,870	5,852	343	38,931
Total hardwoods	582,287	56,961	136,320	177,840	47,766	3,279	160,121
All species	604,433	62,430	138,479	179,754	49,721	3,908	170,141

* Less than one-half cord.

[1] Includes apricot, pear, and Russian olive.

Table 13. -- Residential fuelwood production from roundwood by species group and State, Plains States, 1994

(In cords)

Species group	All States	State			
		Kansas	Nebraska	North Dakota	South Dakota
Softwoods					
Cedar	7,183	2,093	4,375	-	715
Pine	14,963	670	2,070	1,462	10,761
Total softwoods	22,146	2,763	6,445	1,462	11,476
Hardwoods					
Maple	3,391	2,869	460	-	62
Boxelder	8,580	2,963	3,487	1,638	492
Birch	1,120	414	-	706	-
Hickory	4,356	2,046	2,311	-	-
Pecan	1,167	1,167	-	-	-
Catalpa	876	876	-	-	-
Hackberry	13,867	12,618	148	-	1,100
Ash	78,806	21,321	34,678	5,453	17,354
Locust	3,354	2,679	635	40	-
Walnut	9,331	7,481	1,665	-	186
Osage-orange	119,286	115,542	3,744	-	-
Apple[1]	6,833	2,745	3,512	276	300
Mulberry	4,745	3,926	731	-	88
Ironwood	422	-	422	-	-
Cottonwood	96,440	33,344	38,981	9,019	15,096
Aspen	2,306	-	-	670	1,636
Cherry	40	-	-	40	-
Oak	91,414	64,867	21,294	3,524	1,730
Willow	288	45	-	242	-
Elm	135,663	50,889	55,324	11,124	18,326
Total hardwoods	582,287	325,793	167,392	32,733	56,370
All species	604,433	328,556	173,837	34,195	67,846

[1] Includes apricot, pear, and Russian olive.

Table 14. -- Residential fuelwood production from roundwood by species group and ownership class, Plains States, 1994

(In cords)

Species group	All ownerships	Ownership class				
		National Forest	Other federal	State	County/ municipal	Other private
Softwoods						
Cedar	7,183	-	-	-	2,288	4,895
Pine	14,963	4,452	-	137	228	10,147
Total softwoods	22,146	4,452	-	137	2,516	15,042
Hardwoods						
Maple	3,391	-	-	4	89	3,298
Boxelder	8,580	-	-	*	107	8,473
Birch	1,120	-	-	-	-	1,120
Hickory	4,356	-	-	-	1,140	3,216
Pecan	1,167	-	-	-	-	1,167
Catalpa	876	-	-	-	-	876
Hackberry	13,867	-	-	44	-	13,823
Ash	78,806	100	76	136	76	78,418
Locust	3,354	-	-	22	-	3,333
Walnut	9,331	-	-	48	-	9,284
Osage-orange	119,286	-	-	378	-	118,908
Apple[1]	6,833	-	-	74	407	6,352
Mulberry	4,745	-	-	9	32	4,704
Ironwood	422	-	-	-	-	422
Cottonwood	96,440	-	113	708	82	95,537
Aspen	2,306	493	-	-	-	1,813
Cherry	40	-	-	-	-	40
Oak	91,414	111	402	139	4,690	86,072
Willow	288	-	-	*	-	288
Elm	135,663	-	12	743	4,298	130,610
Total hardwoods	582,287	704	603	2,304	10,920	567,755
All species	604,433	5,156	603	2,441	13,436	582,798

* Less than one-half cord.

[1] Includes apricot, pear, and Russian olive.

Table 15. -- Residential fuelwood production from roundwood by source of material and ownership class, Plains States, 1994

(In cords)

Ownership class	All sources	Source of material					
		Cities and villages	Windbreaks, fencerows, rural yards	Pasture and cropland	Forest land		
					Standing live trees	Harvest residues	Dead trees
National forest	5,156	-	-	-	408	902	3,846
Other federal	603	-	-	369	67	-	167
State	2,441	-	623	36	-	-	1,783
County/municipal	13,436	13,304	64	-	-	62	6
Other private	582,798	49,127	137,792	179,349	49,246	2,944	164,339
Total	604,433	62,430	138,479	179,754	49,721	3,908	170,141

Table 16. -- Distribution of timber removals associated with residential fuelwood production by State, Plains States, 1994

(In thousand cubic feet)

State	Timberland removals										
	Growing-stock removals			Non-growing-stock removals					Total timberland removals	Non-timberland removals	Total Removals
	Sawtimber	Poletimber	Total	Limbwood	Sapling	Cull trees	Dead trees	Total			
Kansas	565	456	1,021	590	315	1,166	5,729	7,799	8,820	14,179	22,999
Nebraska	100	75	175	115	37	98	3,613	3,862	4,037	8,131	12,169
North Dakota	5	4	9	3	2	5	547	558	566	1,827	2,394
South Dakota	49	34	83	72	15	42	2,028	2,158	2,240	2,509	4,749
Total	718	569	1,288	780	369	1,310	11,917	14,376	15,664	26,646	42,310

Table 17. -- Distribution of timber removals associated with residential fuelwood production by species group, Plains States, 1994

(In thousand cubic feet)

Species group	Timberland removals								Total timberland removals	Non-timberland removals	Total Removals
	Growing-stock removals			Non-growing-stock removals							
	Sawtimber	Poletimber	Total	Limbwood	Sapling	Cull trees	Dead trees	Total			
Softwoods											
Cedar	11	9	21	8	5	13	139	165	186	317	503
Pine	31	22	52	44	10	27	564	644	697	351	1,047
Total softwoods	42	31	73	52	15	40	703	809	882	668	1,550
Hardwoods											
Maple	24	19	43	16	10	27	2	56	99	139	237
Boxelder	*	*	*	*	*	*	123	123	123	477	601
Birch	-	-	-	-	-	-	29	29	29	49	78
Hickory	1	*	1	1	*	1	30	32	33	272	305
Pecan	-	-	-	-	-	-	-	-	-	82	82
Catalpa	-	-	-	-	-	-	61	61	61	-	61
Hackberry	11	9	20	8	5	12	435	459	479	492	971
Ash	100	80	181	79	42	110	2,388	2,620	2,800	2,716	5,516
Locust	-	-	-	-	-	-	100	100	100	134	235
Walnut	1	*	1	18	*	30	151	199	200	454	653
Osage-orange	-	-	-	158	72	507	992	1,729	1,729	6,621	8,350
Apple[1]	-	-	-	-	-	-	*	*	*	478	478
Mulberry	3	3	6	2	1	4	*	7	13	319	332
Ironwood	-	-	-	-	-	-	30	30	30	-	30
Cottonwood	239	195	434	166	104	270	1,533	2,072	2,506	4,244	6,751
Aspen	6	3	8	17	*	2	46	66	74	88	161
Cherry	-	-	-	-	-	-	-	-	-	3	3
Oak	187	145	332	178	74	194	2,565	3,011	3,343	3,056	6,399
Willow	*	*	*	*	*	*	2	3	3	17	20
Elm	105	84	189	85	44	114	2,726	2,970	3,159	6,338	9,496
Total hardwoods	676	538	1,214	728	355	1,271	11,214	13,567	14,782	25,978	40,760
All species	718	569	1,288	780	369	1,310	11,917	14,376	15,664	26,646	42,310

* Less than 500 cubic feet.

[1] Includes apricot, pear, and Russian olive.

May, Dennis M.
1996. **Residential fuelwood consumption and production in the Plains States, 1994** . Resour. Bull. NC-173. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 26 p.

Reports findings of the latest survey of residential fuelwood consumption and production in the Plains States. Topics examined include the geographic distribution of residential fuelwood consumption and production within the States; the species of trees used for residential fuelwood; the types of wood-burning facilities used; the reasons for burning fuelwood; and the land, ownership, and tree classes from which fuelwood was produced.

KEY WORDS: Fireplace, firewood, harvest, households, roundwood, woodstove.

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Our job at the North Central Forest Experiment Station is discovering and creating new knowledge and technology in the field of natural resources and conveying this information to the people who can use it. As a new generation of forests emerges in our region, managers are confronted with two unique challenges: (1) Dealing with the great diversity in composition, quality, and ownership of the forests, and (2) Reconciling the conflicting demands of the people who use them. Helping the forest manager meet these challenges while protecting the environment is what research at North Central is all about.

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